TDC

Theater Deployable Communications

Baseline Requirements Document

Cellular Hub Module
(CHM) (v1)
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1.0 SCOPE

This requirements document establishes the performance, manufacture and test requirements for the TDC ICAP Cellular Hub Module (CHM) v1.

2.0 APPLICABLE DOCUMENTS

To the extent specified herein, the following documents of latest current issue on the date of this Baseline Requirements Document form part of this BRD.

Table 1 - Standards and Applicable Documents

Document Number	Title
ISO/IEC 8802-3 1996 ANSI/IEEE Std 802.3 1996	Information Technology – Local Metropolitan Area Networks Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA-CD) Access Method and Physical Layer Specification (Documents are one and the same; from IEEE, ANSI, ISO, and IEC.)
S.I. Tech Inc.	Operating Instructions 2890 T-1/2891 E-1 Fiber Bit-Driver
MIL-STD-810F	Environmental Test Methods
	TDC BRD for BTS Module
	TDC BRD for Voice Kits
	TDC BRD for Transmission Kits
	TDC BRD for System Kits
	TDC Standards Document

3.0 REQUIREMENTS

3.1 Module Definitions

The Cellular Hub Module (CHM), Base Transceiver Station (BTS) Module, Cellular Antenna Kit, Cell Phone Kit, Operations and Maintenance Center Kit, and TRX Card and Power Amplifier Kit operate together to provide deployable non-secure and secure cellular voice and data communications. The two Modules and four Kits are shown pictorially in Figure 1. They are described briefly in the following subsections to provide the context in which the TDC cellular system will operate.

3.1.1 Cellular Hub Module (CHM)

The Cellular Hub Module can be located near the base hub of the deployed base or remotely from the base hub. When located close to the base hub, the CHM can be connected to the base hub via standard straight through Universal Service Order Code (USOC): RJ48C cable and CAT-5 Ethernet cable. If the CHM is located remotely from the base hub, it can be connected with media, including wireline, fiber, or LOS radio communication links, provided by TDC transmission facilities.

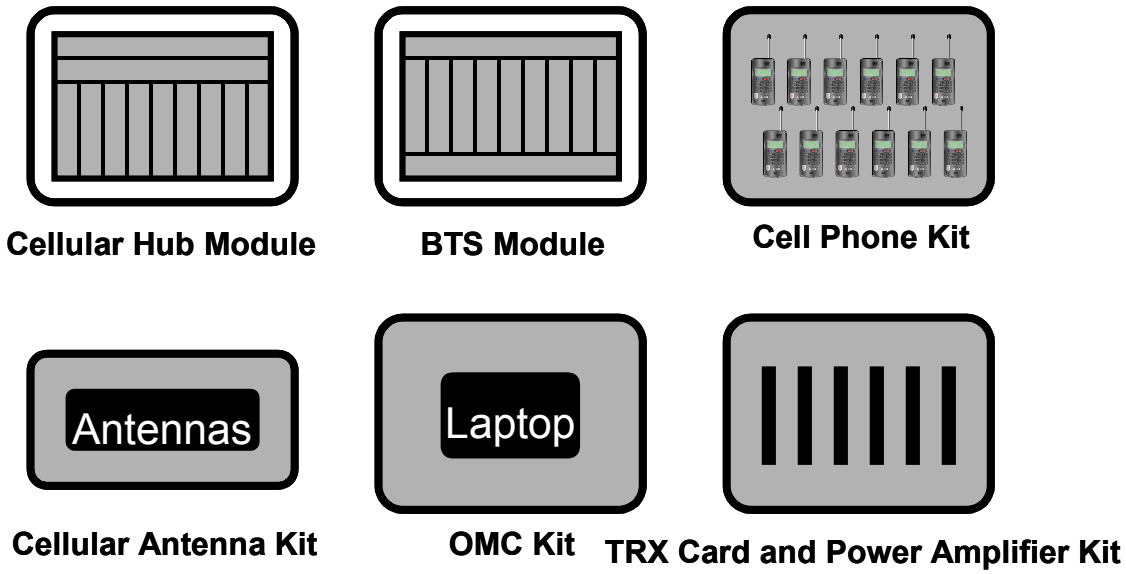

Figure 1 - Cellular Modules and Kits

3.1.2 Base Transceiver Station (BTS) Module

The Base Transceiver Station (BTS) Module provides a BTS that can be located remotely from the CHM and connected to the CHM via wireline, fiber, or radio. A minimum of to two BTS Modules can be connected to a CHM.

Figure 2 shows the Mobile Equipment (cell phone), Cellular Hub Module (CHM), BTS Module, Operations and Maintenance Center (OMC), and CHM connections to TDC Switched Circuit Network (SCN) and the TDC LAN. Internal elements of the CHM and BTS Module are shown in Figure 2.

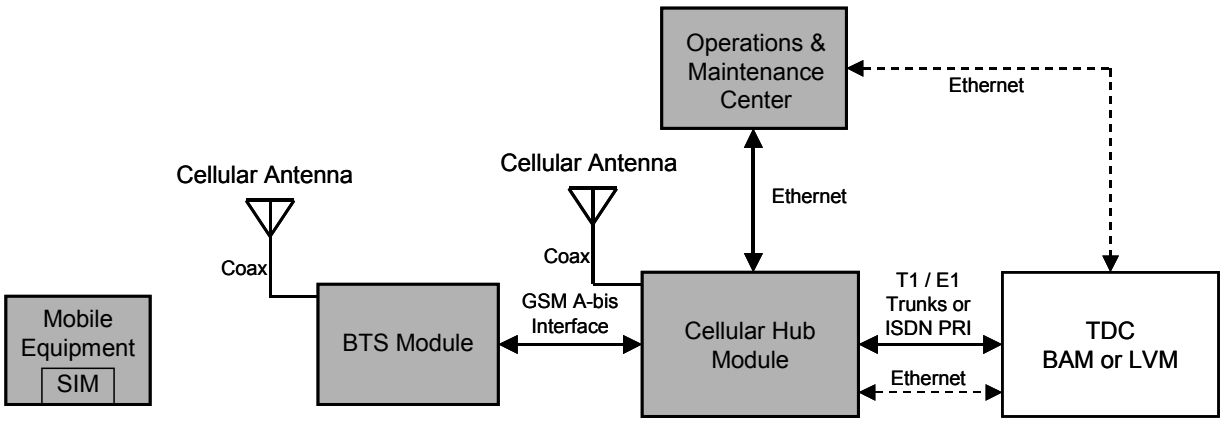

Figure 2 - Deployable Cellular System Connections to TDC ICAP

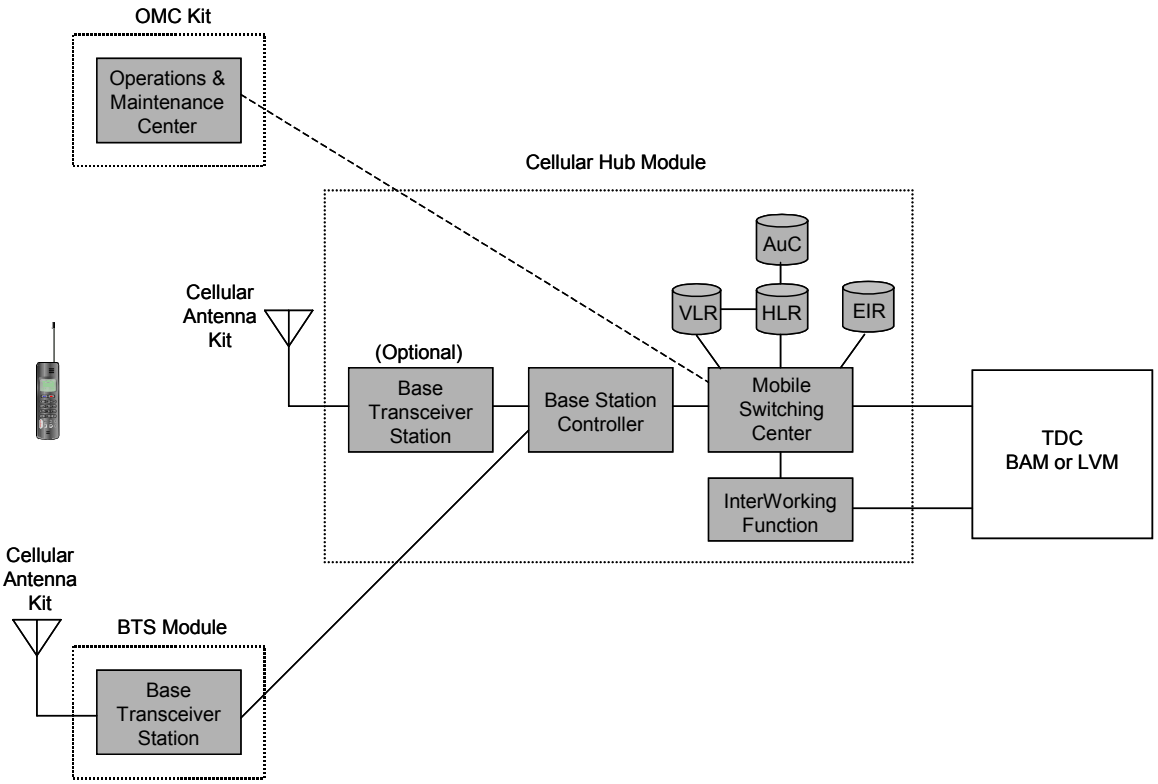

Figure 3 - Deployable Cellular System Internal Elements

3.1.3 Kits Associated with the CHM

3.1.3.1 Cell Phone Kit

The Cell Phone Kit provides 25 GSM cell phones, 25 Sectéra® NSA Type 1 Security Sleeves, and associated Subscriber Information Modules (SIMs), batteries, chargers, and user guides.

3.1.3.2 Cellular Antenna Kit

The Cellular Antenna Kit provides a multi-element cellular antenna and a dipole cellular antenna to accommodate various types of terrain in the theater. Either of these two antenna systems can be mounted on the nine-meter antenna mast provided in the TDC Antenna Mast Kit (detailed in the TDC BRD for Transmission Kits) or on other surfaces as appropriate and connected to the CHM.

3.1.3.3 Operations and Maintenance Center (OMC) Kit

The Operations and Maintenance Center laptop computer interfaces to the CHM and runs software to manage the cellular subscriber databases and perform troubleshooting.

3.1.3.4 TRX Card and Power Amplifier Kit

The TRX Cards and Power Amplifiers kit provides support for operation in the three GSM frequency bands (900, 1800, and 1900 MHz).

3.1.3.5 TDC Large UPS Kit

The TDC Large UPS kit can be used to provide power to the CHM to allow graceful shutdown in the event of power failure.

3.2 Performance Requirements

3.2.1 Electrical Interface Requirements (External)

The Cellular Hub Module includes the number and type of active external interfaces presented in Table 3 and Figure 4. All external interfaces shall be brought out to a Signal Entry Panel.

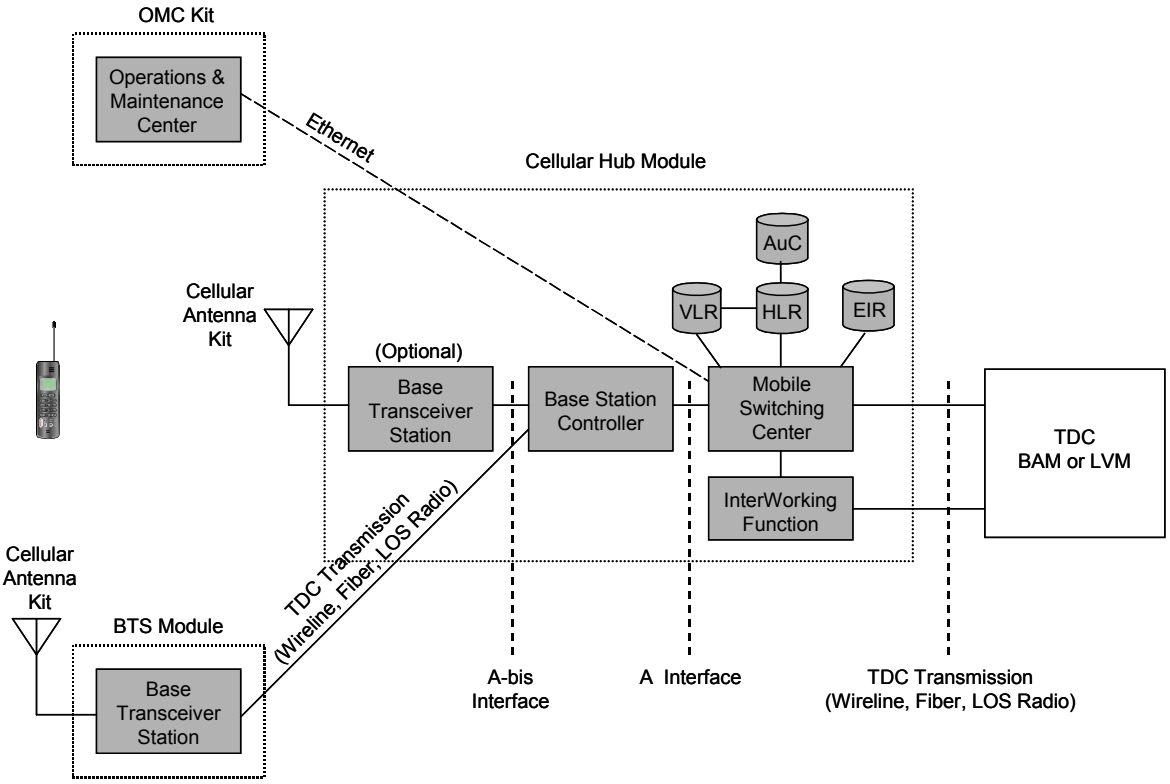

Figure 4 - Deployable Cellular System Block Diagram Showing Interfaces

Table 2 - CHM External Interface Characteristics

Signal Name	Quantity	Connector	Primary Interface	Electrical Characteristics
Prime Power	1	IEC 320 C-20 Receptacle	AC Power	120/240 VAC ± 10%, 47/63 Hz
Cellular Antenna to CHM (optional)	1	Type N Coaxial Connector	Cellular Antenna	RF
BTS Module to CHM	a minimum of 2	RJ-48C	BTS Module (A minimum of 2 modules)	GSM A-bis Interface (Wireline)
BTS Module to CHM	a minimum of 2	ST (Fiber Optic)	BTS Module (A minimum of 2 modules)	GSM A-bis Interface (Multimode Fiber)
OMC to CHM	1	RJ-45	OMC	Ethernet
CHM to LAN	1	ST (Fiber Optic)	OMC	100 Base FX (Multimode Fiber)
CHM to TDC SCN	2	RJ-48C	BAM or LVM	T1 / E1 Trunk (Wireline)

Table 2 - CHM External Interface Characteristics

Signal Name	Quantity	Connector	Primary Interface	Electrical Characteristics
CHM to TDC SCN	2	ST (Fiber Optic)	BAM or LVM	T1 / E1 Trunk (Multimode Fiber)

3.2.1.1 Prime Power

The Cellular Hub Module operates from 120/240 VAC ± 10%, 47/63 Hz, single phase, and three-wire power. The CHM shall include:

- An IEC–320 C-20 male connector (or equivalent) for prime power mounted on the Signal Entry Panel.

- An internal line transient suppressor (Marway 41355 or equivalent) to minimize line variations and provide on-off power switching for each element within the Cellular Hub Module. The internal line transient suppressor shall be positioned to allow easy access to the switches controlling the individual power circuits.

3.2.1.2 CHM to Cellular Antenna Connector

The cellular antenna connector shall be a standard Type N coaxial connector that is lightening protected internal to the CHM. The cellular antenna connector shall be mounted on the Signal Entry Panel.

3.2.1.3 CHM to BTS Module RJ-48C Connector

The CHM communicates with the BTS Module through a GSM compliant 1.5 Mbit/s A-bis interface. The connector shall be a standard female RJ-48C jack mounted on the Signal Entry Panel.

Table 3 - CHM to BTS Module Connector

Pin	Signal
1	TBD
2	TBD
3	TBD
4	TBD
5	TBD
6	TBD
7	TBD
8	TBD

3.2.1.4 CHM to BTS Module Fiber Optic Connector

The CHM can also communicate with the BTS Module via standard TDC transmission media terminating in standard multimode fiber optic ST connectors (transmit and receive). The connector shall be in accordance with the TDC Standards Document referenced in Table 1.

3.2.1.5 CHM to TDC-ICAP Wireline Connector

The CHM communicates with other TDC-ICAP voice modules (BAM and LVM) over standard T1 or E1 trunks. A standard female RJ-48C jack shall be used.

Table 4 - CHM to TDC ICAP Wireline Connector

Pin	Signal
1	TBD
2	TBD
3	TBD
4	TBD
5	TBD
6	TBD
7	TBD
8	TBD

3.2.1.6 CHM to TDC-ICAP Fiber Optic Connector

The CHM can also communicate with TDC-ICAP via standard TDC transmission media terminating in standard multimode fiber optic ST connectors (transmit and receive). The connector shall be in accordance with the TDC Standards Document referenced in Table 1.

3.2.1.7 CHM to Operations and Maintenance Center Connector

The Operations and Maintenance Center (OMC) connector shall be a standard female RJ-45 Ethernet jack mounted on the Signal Entry Panel. The OMC is a laptop PC which connects to the CHM with a standard RJ-45 Ethernet cable in accordance with the TDC Standards Document referenced in Table 1.

3.2.1.8 CHM to TDC LAN

The CHM can also communicate to the OMC via the TDC data network, terminating in standard 100 Base FX multimode fiber optic ST connectors (transmit and receive). The connector shall be in accordance with the TDC Standards Document referenced in Table 1.

3.2.2 Electrical Interface Requirements (Internal)

The Cellular Hub Module utilizes several types of internal interfaces, including GSM-standard Um, A-bis, and A Interfaces.

3.2.3 Functional Requirements

Figure 4 provides a block diagram of the Deployable Cellular System showing the inboard and outboard components. The CHM is made up of:

- Power Conditioner
- Base Transceiver Station (BTS) - optional
- Base Station Controller (BSC)
- Mobile Switching Center (MSC)
- Subscriber Databases (HLR, VLR, EIR, and AuC)
- InterWorking Function (IWF)
- Transcoder Rate Adapation Unit (TRAU) - optional
- Dual Fiber Optic Modem

The optional Base Transceiver Station (BTS) is a bi-directional radio system that communicates with the cellular handsets within a given cell. The Base Station Controller (BSC) manages the radio resources of minimum of three BTSs. In the TDC Cellular Hub Module (CHM), the BSC controls the one BTS in the CHM and a minimum of two external BTSs provided by BTS Modules. A BTS Module can be used to extend cellular service to the distant end of a long runway or to another outlying area on the deployed base. The BTS Modules can be connected to the CHM with media provided in the TDC Transmission Kit. (See TDC BRD for Transmission Kits.) The Mobile Switching Center (MSC) manages call set-up, authentication, routing, and tear-down. The MSC connects to TDC-ICAP.

3.2.3.1 Module Equipment Details

The following sections provide details of the functionality of the major equipment of the Cellular Hub Module.

3.2.3.1.1 Base Transceiver Station (BTS) - Optional

The BTS contains the radio transceivers for a cell. The BTS controls the RF, manages the radio interface, and controls the channel coding and interleaving. The BTS shall communicate with the Mobile Station (cell phone) through the GSM-standard Um Interface.

Each BTS shall provide at least fifteen (15) non-blocking radio channels for full-duplex voice communication. Each BTS shall operate in the 900, 1800, 1900 MHz GSM bands and have a radio power of twelve (12) to forty (40) watts. Each BTS shall accommodate TRX cards and radio power amplifiers to operate in the 900, 1800, 1900 MHz GSM bands from the TRX Card and Power Amplifier Kit. A separate set of cards and amplifiers can be used for each of the three bands. If a separate set of cards is used, any unused sets of cards and amplifiers requiring separate storage must be stored in a transit case meeting the requirements of Paragraph 3.2.4.1.

Broadcast, Pager, and Short Messaging Service (SMS) shall be provided by a combination of BTS, BSC, MCS, IWF, and OMC.

A growth capability to include future requirements, such as operation at 850 Mhz, is hightly desirable, but not required.

3.2.3.1.2 Base Station Controller (BSC)

The BSC manages radio resources, such as channel set-up/tear-down, handovers, frequency hopping, and transcoder rate adaptation. The BSC controls one or more BTSs through the GSM-standard A-bis interface. The BSC shall communicate with the Mobile Switching Center (MSC) through the industry-standard GSM A interface.

3.2.3.1.3 Mobile Switching Center (MSC)

The MSC manages call routing and establishment, authentication, and connection to fixed networks. The MSC shall connect to the external tactical voice network (TDC) via standard T-1/ E-1 (selectable) and ISDN Primary Rate Interface (PRI) interfaces. The MSC shall provide a minimum of 45 voice channels to the external tactical voice network. The MSC shall be capable of industry-standard R1 and R2 signaling to the external tactical voice network. The MSC shall provide echo cancellation.

Multi-Level Precedence and Preemption (MLPP) is highly desirable, but is not a required feature.

The MSC interfaces to four databases: Home Location Register (HLR), Visitor Location Register (VLR), Equipment Identity Register (EIR), and Authentication Center (AuC). These databases can be combined into one or more single databases. The database(s) shall be manageable from the Operations and Maintenance Center (OMC) Kit.

3.2.3.1.3.1 Home Location Register (HLR)

The Home Location Register (HLR) is an intelligent database that stores subscriber information and current location of all subscribers in a given network.

3.2.3.1.3.1 Visitor Location Register (VLR)

The Visitor Location Register (VLR) is associated with one or more MSCs. It contains subscriber information needed for call control, for all mobile phones in the area controlled by the MSC. This information is copied once from the HLR during registration.

3.2.3.1.3.1 Equipment Identity Register (EIR)

The Equipment Identity Register (EIR) contains the International Mobile Equipment Identity (IMEI) of all registered mobile equipment, marked as black, gray, or white listed, depending on whether it is type approved or has been reported lost or stolen.

3.2.3.1.3.1 Authentication Center (AuC)

The Authentication Center (AuC) provides an intelligent database used for authentication and encryption procedures. The AuC stores the secret key held in the SIM card.

3.2.3.1.4 InterWorking Function (IWF)

The InterWorking Function shall convert V.110 to V.32, and vice-versa to enable the secure Sectera-equipped cell phones to operate in the secure mode. The IWF shall connect to the BSC and/or MSC through GSM-standard interfaces.

3.2.3.1.4.1 Data Protocol Management System (DPMS)

It is acceptable to combine the HLR, VLR, EIR, AuC, and IWF into one Data Protocol Management System (DPMS).

3.2.3.1.5 Transcoder and Rate Adaptation Unit (TRAU)

The Transcoder and Rate Adaptation Unit (TRAU) may be incorporated in either the CHM or the BTS Module. The TRAU, if employed, shall be capable of carrying speech, data, and operations and maintenance frames at full rate (16 kbps) and half rate (8 kbps).

3.2.3.1.6 Co-Mounting

It is acceptable to mount the BTS, BSC, MSC, Databases (HLR, VLR, EIR, AuC) and IWF, DPMS, or TRAU in one transit case.

3.2.3.1.7 Voice Interfaces

The MSC shall connect to the external tactical voice network (TDC) via standard T-1/E-1 (selectable) and ISDN Primary Rate Interface (PRI) interfaces. The MSC shall provide a minimum 45 voice channels to the external tactical voice network. The MSC shall be capable of industry-standard R1 and R2 signaling to the external tactical voice network.

3.2.3.1.8 Data Interfaces

The OMC shall connect to the MSC via a standard RJ-45 Ethernet connector or 100 Base FX Ethernet as defined in the TDC standards documents.

The IWF shall connect to an external data network via 2 ISDN PRIs for transmitting data and passing secure calls. The IWF shall provide a minimum of 45 data or Type 1 encrypted voice channels to the external tactical voice network.

3.2.3.1.9 Operator Interface

Operator interface to the CHM is through an Operations and Maintenance Center (OMC) to enable an operator to configure, monitor the performance, and diagnose faults of the CHM and

BTS Modules. The OMC is provided in the OMC Kit and can be used locally or remotely over an IP network.

3.2.3.1.10 Built-In Test

The OMC includes continuously running diagnostics to detect and report major faults in CHM and BTS Modules. The OMC includes built-in diagnostics to aid the operator in isolating faults to the LRU level.

3.2.3.2 Configuration Options

In addition to the basic functions and features, the installer may customize the Cellular Hub Module by adding up to a minimum two BTS Modules per CHM plus associated Kits. The Kits are listed below:

- Cell Phone Kit (1 required for each CHM, an extra Kit will provide additional cell phones)
- Cellular Antenna Kit (1 required for each BTS Module)
- TRX Card and Power Amplifier Kit (1 required for each BTS Module)
- Operations and Maintenance Center (OMC) Kit (1 required for each CHM)

3.2.4 Physical Characteristics

3.2.4.1 Transit Cases

The Cellular Hub Module shall be housed in a man-transportable ECS Composites transit case(s), in accordance with the TDC Standards Document referenced in Table 1.

3.2.4.2 Storage Space

The Cellular Hub Module transit case(s) shall include storage pouches within each cover to contain cables, manuals, etc. that must be transported and used with the Module, in accordance with the TDC Standards Document referenced in Table 1.

3.2.4.3 Weight

The Cellular Hub Module, including all internally carried cables, manuals, etc. shall meet the two-man (78 kg/174 lb.) lifting limits in accordance with the TDC Standards Document in Table 1.

3.2.4.4 Marking

Markings shall be in accordance with the TDC Standards Document referenced in Table 1.

3.2.5 Cables and Accessories

The Cellular Hub Module includes cables listed in Table 5, stored within the module's covers. Strain relief and cable management hardware are provided with the module.

Table 5 - Cables Included with Cellular Hub Module

Function	Color Code	Quantity	Description
Power	TBD	1	IEC–320 receptacle to NEMA 5–15P
Voice Trunk	TBD	2	25’ RJ-48C each end
Voice Trunk	TBD	2	40’ Dual fiber optic ST to ST cable
LAN	TBD	1	40’ Dual fiber optic ST to ST cable
IWF	TBD	2	25’ RJ-45 each end
IWF	TBD	2	40’ Dual fiber optic ST to ST cable
OMC	TBD	1	15’ RJ-45 Ethernet Cable

3.2.6 Reliability

The Cellular Hub Module, with its standard complements of LRUs, has a mean time between failure (MTBF) commensurate with similar commercial equipment in its class. The actual MTBF for the major system components are shown in Table 6. Where Reliability data is not readily available from the vendor, this is indicated.

Table 6 - MTBF of Major Components

Components	MTBF
Power Conditioner	TBD
Base Transceiver Station (BTS) - if equipped	TBD
Base Station Controller (BSC)	TBD
Mobile Switching Center (MSC)	TBD
Data Base System (HLR, VLR, EIR, AuC)	TBD
InterWorking Function (IWF)	TBD
Data Protocol Management System (DPMS)	TBD
Transcoder Rate Adaptation Unit (TRAU) - if equipped	TBD
Dual Fiber Optic Modem	TBD

3.2.7 Maintainability

Maintainability characteristics will be part of the selection criteria for all hardware. Ease of maintenance, such as accessibility to Line Replaceable Units, fault detection/isolation software capability, and fault annunciation will be considered.

3.2.7.1 Mean Time Between Preventive Maintenance

The Mean Time Between Preventive Maintenance, during operation, is 30 days. The duration of preventive maintenance actions such as corrosion control, cleaning filters, etc., does not exceed 30 minutes.

3.2.8 Environmental Conditions

During storage, transport and operation the modules can withstand exposure to temperatures as shown in Table 7.

3.2.8.1 Temperature

Temperature characteristics for the major equipment components are shown in Table 7.

Table 7 - Module Temperature Characteristics

Equipment	Temperature (degrees C)	
	Operating	Non-Operating
Power Conditioner	-5 to 45	TBD
Base Transceiver Station (BTS)	-5 to 45	TBD
Base Station Controller (BSC)	-5 to 45	TBD
Mobile Switching Center (MSC)	-5 to 45	TBD
Data Base System (HLR, VLR, EIR, AuC)	-5 to 45	TBD
InterWorking Function (IWF)	-5 to 45	TBD
Data Protocol Management System (DPMS)	-5 to 45	TBD
Transcoder Rate Adaptation Unit (TRAU) - if equipped	-5 to 45	TBD

3.2.8.2 Relative Humidity

Relative humidity characteristics for the major equipment components are shown in Table 8.

Table 8 - Module Humidty Characteristics

Equipment	Humidity
	Non-condensing
Power Conditioner	10 to 90%
Base Transceiver Station (BTS)	10 to 90%
Base Station Controller (BSC)	10 to 90%
Mobile Switching Center (MSC)	10 to 90%
Data Base System (HLR, VLR, EIR, AuC)	10 to 90%
InterWorking Function (IWF)	10 to 90%
Data Protocol Management System (DPMS)	10 to 90%
Transcoder Rate Adaptation Unit (TRAU) - if equipped	10 to 90%
Dual Fiber Optic Modem	10 to 90%

3.2.8.3 Altitude

Altitude characteristics for the major equipment components are shown in Table 9.

Table 9 - Module Altitude Characteristics

Equipment	Altitude (feet)	
	Operating	**Non-Operating**
Power Conditioner	TBD	TBD
Base Transceiver Station (BTS)	TBD	TBD
Base Station Controller (BSC)	TBD	TBD
Mobile Switching Center (MSC)	TBD	TBD
Data Base System (HLR, VLR, EIR, AuC)	TBD	TBD
InterWorking Function (IWF)	TBD	TBD
Data Protocol Management System (DPMS)	TBD	TBD
Transcoder Rate Adaptation Unit (TRAU) - if equipped	TBD	TBD
Dual Fiber Optic Modem	TBD	TBD

3.2.8.4 Sand and Dust

During storage and transport, the modules are protected when exposed to sand and dust in accordance with the best commercial practices for close proximity to operating aircraft. During operation with covers removed, the modules can withstand sand and dust in accordance with the best commercial practices for natural conditions.

3.2.8.5 Shock

Module equipment racks are equipped with rubber shock isolation mounts and is protected from shocks induced during handling, setup and tear down. Modules and components can operate without degradation following exposure to the non-operating shock environment described by Method 516.5, Procedure VI (Bench Handling) of MIL STD 810F.

3.2.8.6 Vibration

The modules are equipped with rubber shock isolation mounts so that the modules can withstand the vibration encountered while being transported by commercial and military airlift, sealift and vehicular (over unimproved roads) systems. MIL-STD-810F, Method 514.5, Procedure I, Categories 4, 7 and 8 applies; alternative procedures may be substituted after approval of the TDC Program Office.

3.3 Design and Construction

3.3.1 Material Parts and Processes

This module is built to good commercial practices. Mechanical and electrical interchangeability exists between like systems, subsystems, assemblies, subassemblies and replaceable parts.

3.3.2 Safety

This module shall not present a safety, fire or health hazard to personnel.

3.3.2.1 Electrical Safety

This module is designed to eliminate the hazard to personnel of inadvertent lethal voltage contact. All electrical conductors carrying voltages in excess of 70 volts shall be insulated to prevent contact or covered by a protective barrier. All removable protective barriers shall be interlocked to automatically disconnect power behind the barrier upon removal or clearly marked with a warning label that indicates the voltage potential that will be encountered behind the barrier. All warning labels shall remain visible after the cover has been removed.

3.3.2.2 Mechanical Safety

Sharp surfaces shall have protective covers or other suitable features to minimize injury where personnel are likely to be exposed to such surfaces.

3.4 Logistics

This module accommodates a two level maintenance concept: organizational (Air Force personnel) and depot (contractor personnel). Removal and replacement of an LRU is defined at the organizational level and any needed repair of the LRU is defined at the depot level. Any special test or support equipment required to effect removal or replacement of an LRU at the organizational level can be provided as part of the module. No more than two persons shall be required to remove or replace an LRU.

An LRU is defined as the lowest element of the module which can be isolated to be faulty through inspection; built-in test; technical manuals; TDC-ICAP system performance; spares substitution; or other diagnostic aid approved by the Government for organizational level maintenance, exclusive of expendables such as fuses, lamps and LEDs. An LRU is defined at the card/module level or higher.

4.0 QUALITY ASSURANCE PROVISIONS

4.1 General

The quality assurance program includes tests and other evaluations to the extent specified herein. The quality assurance program is designed to verify the electrical, mechanical and functional characteristics of each module. The purpose is to ensure that each module complies with or performs better than the requirements specified herein.

4.2 Responsibility for Inspection

Unless otherwise specified in the contract, the contractor shall be responsible for the performance of all inspection requirements and may use his own or any other facilities suitable for the performance of the inspection requirements. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to the prescribed requirements.

4.3 Product Qualification Test (PQT)

Inspections, analyses, demonstrations and tests verify compliance of Section 3 of this specification on the first production unit.

4.4 Production Acceptance Test (PAT)

Each module delivered to the Government undergoes an Acceptance Test Process as identified in Table 10. The acceptance test verifies that the module interfaces are operating properly prior to delivery to the Government.

4.5 Verification Cross Reference Matrix (VCRM)

Table 10 provides a list of each Section 3 requirement and the verification method to be used. The following paragraphs define the codes employed in the VCRM. Unless otherwise noted, where more than more one verification method is shown, one method or a combination of methods may be used to show compliance.

4.5.1 Not Required (N/R)

This method indicates that verification is not required because the paragraph is a title, heading, general introductory paragraph or statement of a goal and contains no “shall” or “must” statements.

4.5.2 Inspection

Inspection is a method of verification of the module performance or characteristics by examination of the equipment or associated documentation. Inspections are conducted with the use of inspection tools, measurement devices, visual means and comparison. Most inspections apply to verification of requirements associated with physical characteristics such as size, weight,

appearance, adherence to specified standards and engineering practices, quality design, and construction supported with quality documentation. Inspections also include the auditing of manufacturer's data that verifies the performance of non-developmental items that comprise the TDC ICAP module. Inspections may occur during any assembly stage of the unit under test.

4.5.3 Analysis

Analysis is a method of verification through technical evaluation of calculations, computations, models, analytical solutions, use of studies, reduced data, and/or representative data to determine that the item conforms to the specified requirements.

4.5.4 Demonstration

Demonstration is a method of verification whereby the properties, characteristics and parameters of the item are determined by observation alone and without the use of instrumentation for quantitative measurements. This method is used when a requirement does not contain a specific numerical parameter that must be measured. Demonstrations may occur during verification of a unit under test at any assembly stage. Pass/fail criteria are simple yes/no indications of functional performance since no quantitative values are specified.

4.5.5 Test

Test is a method to verify that a specified requirement is met by thoroughly exercising the applicable item under specified conditions and by using the appropriate instrumentation in accordance with test procedures. This method requires the use of laboratory equipment, simulators, or services to verify compliance to the specified requirements. This method is used when it is practicable to make direct or indirect measurement of a specified numerical parameter to verify compliance with a requirement. Tests may occur during verification of a unit at any assembly stage. Actual measured values are recorded, and pass/fail is determined by comparing the measured value with the specified value. Measurement accuracy is precise enough to ensure that the measured value is within the specified tolerance.

Table 10 - Verification Cross Reference Matrix

		Verification Method					
			PQT				
Paragraph	Title	N/R	Inspect	Analysis	Demo	Test	ATP
3.	REQUIREMENTS	X					
3.1	Module Definition	X					
3.1.1	Cellular Hub Module (CHM)	X					
3.1.2	Base Transceiver Station (BTS) Module	X					
3.1.3	Cell Phone Kit	X					
3.1.4	Cellular Antenna Kit	X					

Table 10 - Verification Cross Reference Matrix

Paragraph	Title	Verification Method					
			PQT				
		N/R	Inspect	Analysis	Demo	Test	ATP
3.1.5	Operations Maintenance Console (OMC) Kit	X					
3.1.6	TRX Card and Power Amplifier Kit	X					
3.1.7	TDC Large UPS Kit	X					
3.2	Performance Requirements	X					
3.2.1	Electrical Interface Requirements (External)		X				
3.2.1.1	Prime Power					X	
3.2.1.2	CHM to Cellular Antenna Connector - if equipped				X		
3.2.1.3	CHM to BTS Module RJ-45 Connector				X		
3.2.1.4	CHM to BTS Module Fiber Optic Connector				X		
3.2.1.5	CHM to TDC-ICAP Wireline Connector				X		
3.2.1.6	CHM to TDC-ICAP Fiber Optic Connector				X		
3.2.1.7	CHM to Operations & Maintenance Center (OMC) Connector				X		
3.2.2	Electrical Interface Requirements (Internal)	X					
3.2.3	Functional Requirements	X					
3.2.3.1	Module Equipment Details	X					
3.2.3.1.1	Base Transceiver Station (BTS) - if equipped				X		X
3.2.3.1.2	Base Station Controller (BSC)				X		X
3.2.3.1.3	Mobile Switching Center (MSC)				X		X
3.2.3.1.3.1	Home Location Register (HLR)				X		X
3.2.3.1.3.2	Visitor Location Register (VLR)				X		X
3.2.3.1.3.3	Equipment Identity Register (EIR)				X		X
3.2.3.1.3.4	Authentication Center (AuC)				X		X
3.2.3.1.4	InterWorking Function (IWF)				X		X
3.2.3.1.4.1	Data Protocol Management System (DPMS)				X		X
3.2.3.1.5	Transcoder Rate Adaptation Unit (TRAU) - if equipped				X		X
3.2.3.1.6	Co-Mounting		X				
3.2.3.1.7	Voice Interfaces				X		X
3.2.3.1.8	Data Interfaces				X		X

Table 10 - Verification Cross Reference Matrix

Paragraph	Title	Verification Method					
			PQT				
		N/R	Inspect	Analysis	Demo	Test	ATP
3.2.3.1.9	Operator Interface				X		X
3.2.3.1.10	Built-In Test				X		X
3.2.3.2	Configuration Options	X					
3.2.4	Physical Characteristics	X					
3.2.4.1	Transit Case		X				
3.2.4.2	Storage Space		X				
3.2.4.3	Weight					X	
3.2.4.4	Marking		X				X
3.2.5	Cables and Accessories				X		
3.2.6	Reliability			X			
3.2.7	Maintainability			X			
3.2.7.1	Mean Time Between Preventive Maintenance			X			
3.2.8	Environmental Conditions	X					
3.2.8.1	Temperature					X	
3.2.8.2	Relative Humidity			X			
3.2.8.3	Altitude			X			
3.2.8.4	Sand and Dust			X			
3.2.8.5	Shock					X	
3.2.8.6	Vibration					X	
3.3	Design and Construction	X					
3.3.1	Materials Parts and Processes			X			
3.3.2	Safety	X					
3.3.2.1	Electrical Safety			X		X	
3.2.2.2	Mechanical Safety		X	X			
3.4	Logistics			X			

5.0 PREPARATION FOR DELIVERY

Each module is packaged for shipment and the package marked in accordance with the requirements of the contract under which the module is ordered.

6.0 BASELINE CONFIGURATION

6.1 Equipment

Table 11 - Components

Device	Manufacturer	Part Number	Description	Quantity
Power Conditioner	Marway	411355	Power Conditioner – 16A	1
Integrated BTS (if equipped), BSC, and MSC	InterWave or Other		Integrated BTS, BSC, MSC w/12 Watt Transceivers (1800 MHz)	1
IWF or DPMS	InterWave or Other		InterWorking Function or Data Protocol Management System	1
Transcoder Rate Adaptation Unit (TRAU) - if equipped	TBD		Transcoder Rate Adaptation Unit (TRAU)	1
Fiber Optic Modem	S.I. Tech	2890-2R-ASP-1	Dual T-1 Fiber Optic Modem	2
Transit Case	ECS Composites		Transit Case	1
Cable (in pouch)	TBD	TBD	Power Cable	1
Cable (in pouch)	TBD	TBD	Cable, Ethernet (RJ-45 to RJ-45)	1
Cable (in pouch)	TBD	TBD	Cable, RJ-48C to RJ-48C	4
Cable (in pouch)	TBD	TBD	Fiber Optic Cable (ST to ST)	5

6.2 Elevation Drawings

To Be Supplied by Contractor

Figure 5 - Front Elevation

To Be Supplied

Figure 6 - Rear Elevation

6.3 Cable Diagrams

To be supplied by contractor.

Table 12 - Cables

Wire Number	Part Number	Manufacturer	Description

6.4 Interconnection Diagram

To be supplied by contractor.